

CLAIMS:

1. A star, dendrimer or hyper-branched flowable prepolymer composition comprising the reaction product of isocyanate and low molecular weight multifunctional core molecules having at least two and preferably three or more functional groups that react with said isocyanate to form urethane or urea groups.
- 5 2. A prepolymer composition as claimed in claim 1 wherein said low molecular weight multifunctional core molecule is selected from the group consisting of diols, triols, and polyols such as sugar molecules.
3. A prepolymer composition as claimed in claim 1 or 2 wherein said low 10 molecular weight core molecule has a molecular weight of 400 or less.
4. A prepolymer composition as claimed in any one of claims 1-3 wherein said isocyanate is optionally substituted aliphatic, aromatic and hindered isocyanate.
5. A prepolymer composition as claimed in any one of claims 1-4 wherein 15 said isocyanates are aliphatic and asymmetric in molecular shape. A prepolymer composition as claimed in any one of claims 1-4 wherein
6. A prepolymer composition as claimed in any one of claims 1-5 wherein the viscosity of the prepolymer composition on preparation is about 15,000-200,000 cSt at room temperature.
- 20 7. A prepolymer composition as claimed in any one of claims 1-6 further comprising biological and inorganic components selected from the group consisting of cells, progenitor cells, growth factors, other components for supporting cell growth, calcium phosphate, hydroxyapatite, adhesives including fibrin, collagen and transglutaminase systems, surfactants including siloxane 25 surfactants, porogens including silica particles, powdered silica, sugars and sodium chloride type salts, polymeric hollow fibres and gelatin beads.

8. A prepolymer composition as claimed in any one of claims 1-7 comprising the reaction product of pentaerythritol and methyl 2,6-diisocyanato hexanoate.
9. A prepolymer composition as claimed in any one of claims 1-7 comprising the reaction product of glucose and methyl 2,6-diisocyanato hexanoate.
- 5 10. A prepolymer composition as claimed in any one of claims 1-7 comprising the reaction product of glucose and ethyl 2,6-diisocyanato hexanoate.
11. A biodegradable biocompatible polyurethane/urea polymer composition comprising the reaction product of a prepolymer as claimed in any one of claims 1-7 and linear star dendrimer or hyperbranched soft segment forming functional 10 oligomers with degradable arms.
12. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 wherein said linear star dendrimer or hyperbranched soft segment forming functional oligomer with degradable arms is selected from the group consisting of lactides, glycolides, lactide/glycolides, caprolactones, 15 propylene fumarates, glycolic acid, dioxanones, anhydrides, polyorthoesters and phosphorylcholines.
13. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 or 12 wherein said linear star dendrimer or hyperbranched soft segment forming functional oligomer with degradable arms is zwitterionic.
- 20 14. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 or 12 comprising the reaction product of water, polycaprolactone triol and a prepolymer comprising the reaction product of pentaerythritol and methyl 2,6-diisocyanato hexanoate.
15. A biodegradable biocompatible polyurethane/urea polymer composition as 25 claimed in claim 11 or 12 comprising the reaction product of water, polycaprolactone triol and a prepolymer comprising the reaction product of glucose and methyl 2,6-diisocyanato hexanoate.

16. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 or 12 comprising the reaction product of water and polycaprolactone triol and a prepolymer comprising the reaction product of glucose and ethyl 2,6-diisocyanato hexanoate.
- 5 17. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 or 12 comprising the reaction product of polycaprolactone triol and dihydroxypolycaprolactone phosphoryl choline and a prepolymer comprising the reaction product of pentaerythritol and methyl 2,6-diisocyanato hexanoate.
- 10 18. A biodegradable biocompatible polyurethane/urea polymer composition as claimed in claim 11 or 12 comprising the reaction product of polycaprolactone triol and a 1,2-dihydroxy-N,N-dimethylaminopropane sulfonate zwitterion and a prepolymer comprising the reaction product of glucose and methyl 2,6-diisocyanato hexanoate.
- 15 19. A biodegradable, biocompatible polymeric scaffold comprising a cured biocompatible, biodegradable polyurethane/urea composition as claimed in any one of claims 14 - 18.
20. A biodegradable, biocompatible polymeric scaffold as claimed in claim 19 having a compressive strength in the range of 0.05— 80 MPa.
- 20 21. A biodegradable, biocompatible polymeric scaffold as claimed in claim 19 or 20 having pores in a size range of 150 - 300 micron.
- 25 22. A biodegradable, biocompatible polymeric scaffold as claimed in any one of claims 14 -21 further comprising biological components selected from the group consisting of cells, progenitor cells, growth factors, other components for supporting cell growth, calcium phosphate, hydroxyapatite, adhesives including fibrin, collagen and transglutaminase systems, surfactants including siloxane surfactants, porogens including silica particles, powdered silica, , sugars, sodium chloride type salts, polymeric hollow fibres and gelatin beads

23. A process for the preparation of a biocompatible, biodegradable polyurethane/urea composition as claimed in any one of claims 11 - 18 comprising

reacting an isocyanate with a core molecule having at least two and
5 preferably three or more functional groups that react with said isocyanate to form urethane or urea groups under suitable conditions to form a prepolymer composition with a flowable viscosity; and

reacting said prepolymer with a star soft segment forming functional oligomer with degradable arms and optionally, appropriate amounts of water and
10 catalyst under conditions such that the reaction temperature does not exceed 90°C, preferably 60°C, more preferably 40°C.

24. A process as claimed in claimed in claim 23 wherein the functional oligomer is soluble in said prepolymer.

25. A process as claimed in claim 23 or 24 further comprising the step of
15 reacting said prepolymer with high molecular weight degradable polymer selected from the group consisting of PLGA, PLLA and poly(anhydrides).

26. A biodegradable, biocompatible polyurethane/urea scaffold prepared by
reacting an isocyanate with a core molecule having at least two and
20 preferably three or more functional groups that react with said isocyanate to form urethane or urea groups under suitable conditions to form a flowable prepolymer;
and

reacting said prepolymer with a star soft segment forming functional oligomers with degradable arms and optionally, appropriate amounts of water and
catalyst under conditions such that the reaction temperature does not exceed
25 90°C, preferably 60°C, more preferably 40°C.

27. A method of treatment of damaged bone or cartilage in a patient requiring such treatment, the method comprising administering to said patient a biocompatible, biodegradable polyurethane/urea composition as claimed in any one of claims 11 - 18, said administration occurring by the implant of a scaffold

formed ex-vivo from a cured form of said polyurethane/urea composition, or by the injection of said polymer in an uncured form for in-vivo curing and scaffold formation.

28. Use of a biocompatible, biodegradable polyurethane/urea composition as
5 claimed in any one of claims 11 - 18 as a scaffold for assistance in tissue
engineering applications such as bone and cartilage repair.